FIG. 1

PRIOR ART

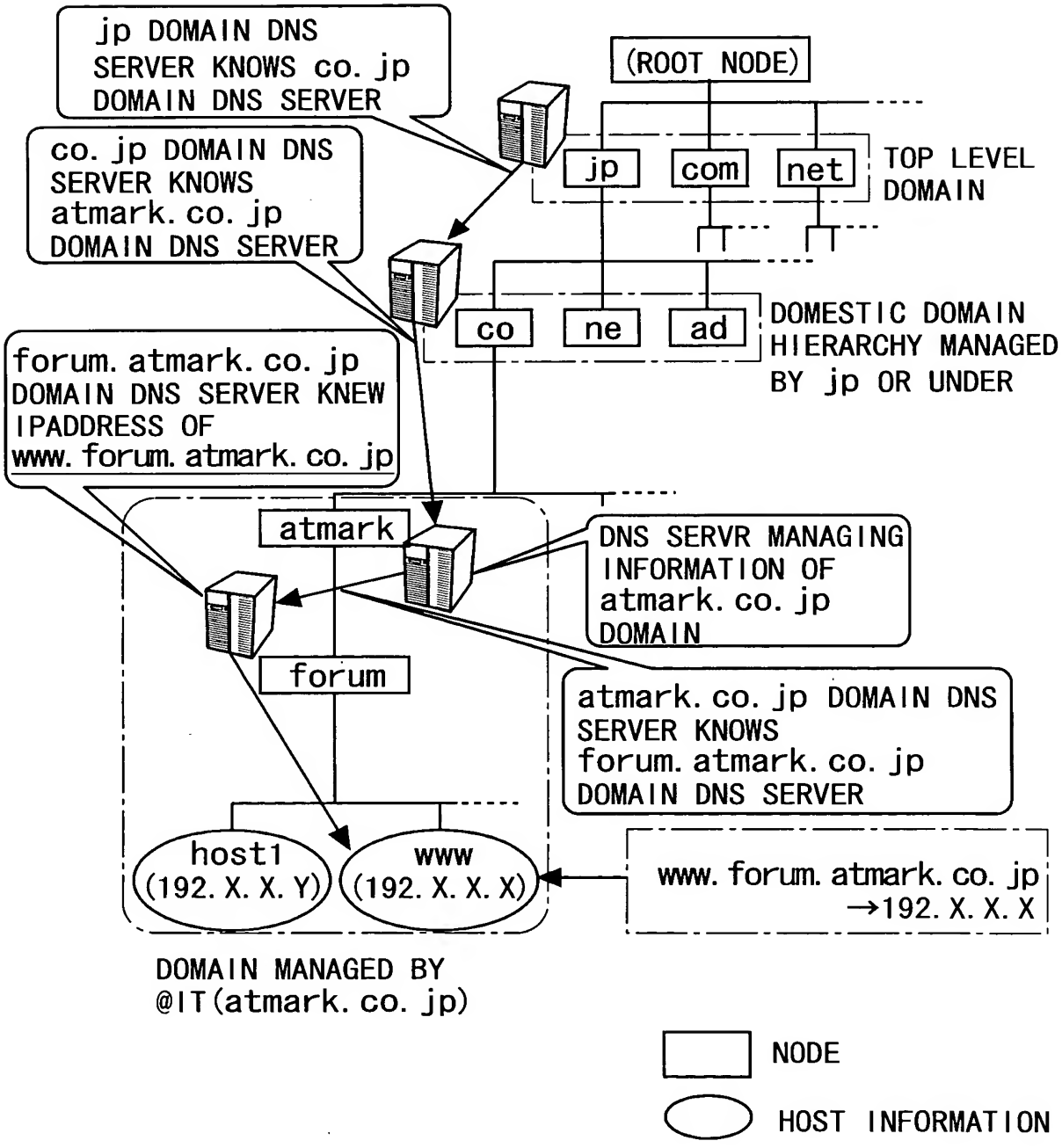


FIG. 2A
PRIOR ART

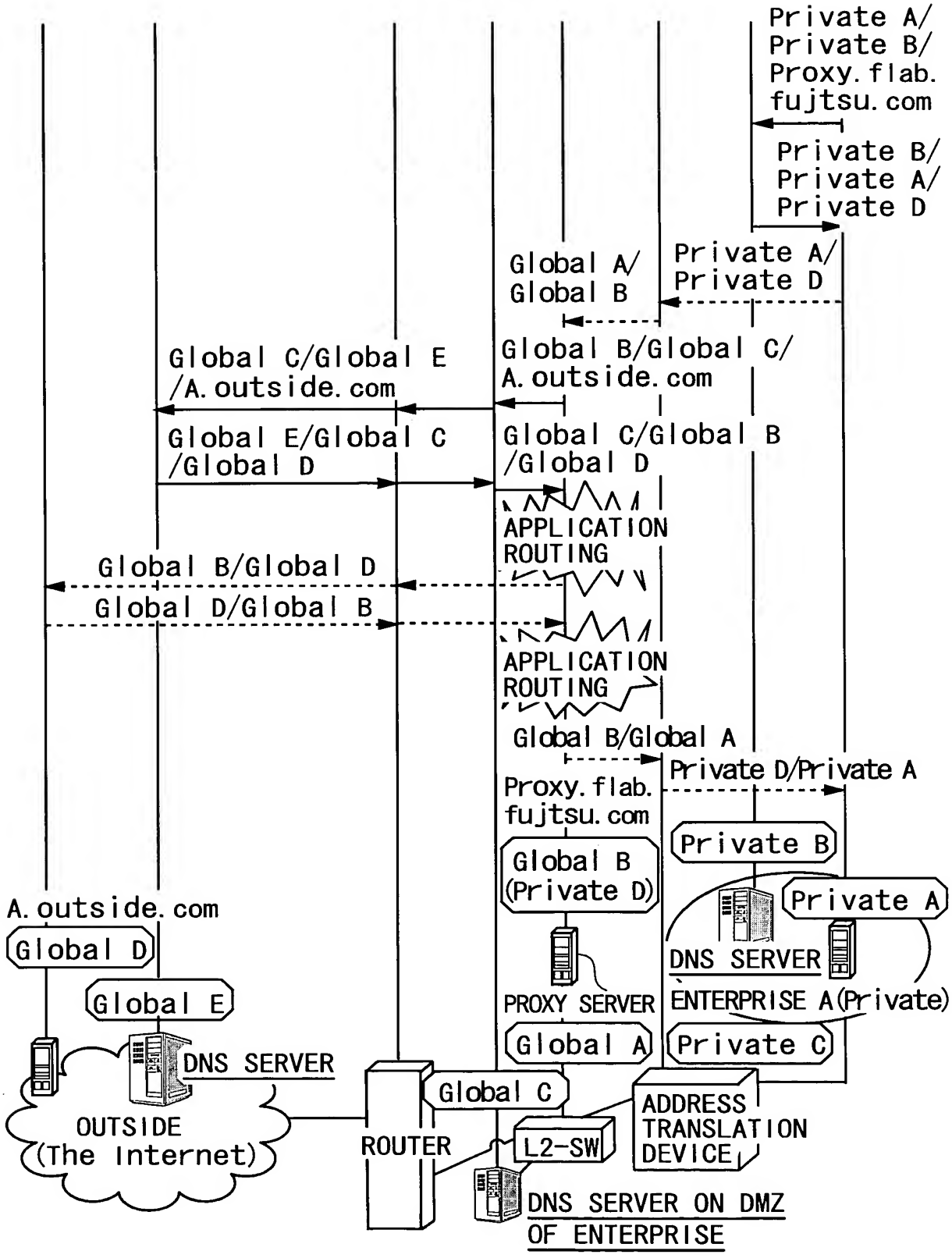


FIG. 2B

PRIOR ART

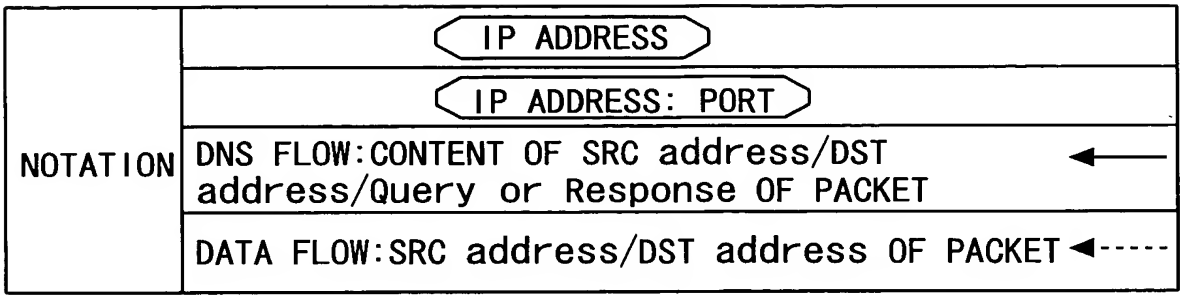


FIG. 3A

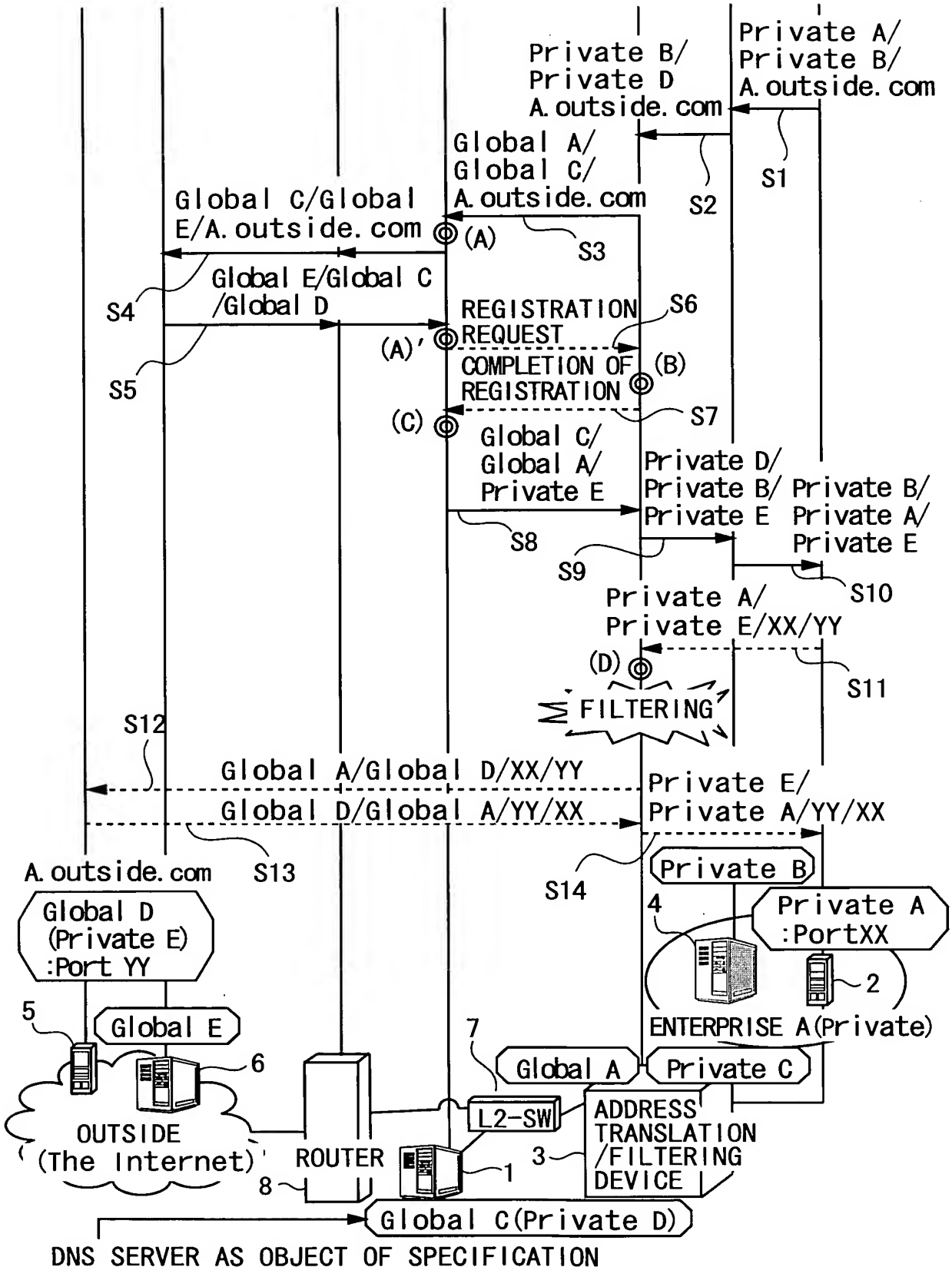

Private B/
Private D
A.outside.com
Private A/
Private B/
A.outside.com
Global A/
Global C/
A.outside.com
S1
S2
Global C/Global
E/A.outside.com
(A)
S3
Global E/Global C
/Global D
S4
S5
REGISTRATION
REQUEST
S6
(A)'
COMPLETION OF
REGISTRATION
(B)
(C)
S7
Global C/
Global A/
Private E
Private D/
Private B/
Private E
Private B/
Private A/
Private E
S8
S9
S10
Private A/
Private E/XX/YY
(D)
S11
FILTERING
S12
Global A/Global D/XX/YY
Private E/
Private A/YY/XX
Global D/Global A/YY/XX
S13
S14
A.outside.com
Private B
Global D
(Private E)
:Port YY
4
Private A
:PortXX
2
5
Global E
ENTERPRISE A(Private)
7
Global A
Private C
6
L2-SW
ADDRESS
TRANSLATION
/FILTERING
DEVICE
OUTSIDE
(The Internet)
ROUTER
3
1
8
Global C(Private D)
DNS SERVER AS OBJECT OF SPECIFICATION

FIG. 3B

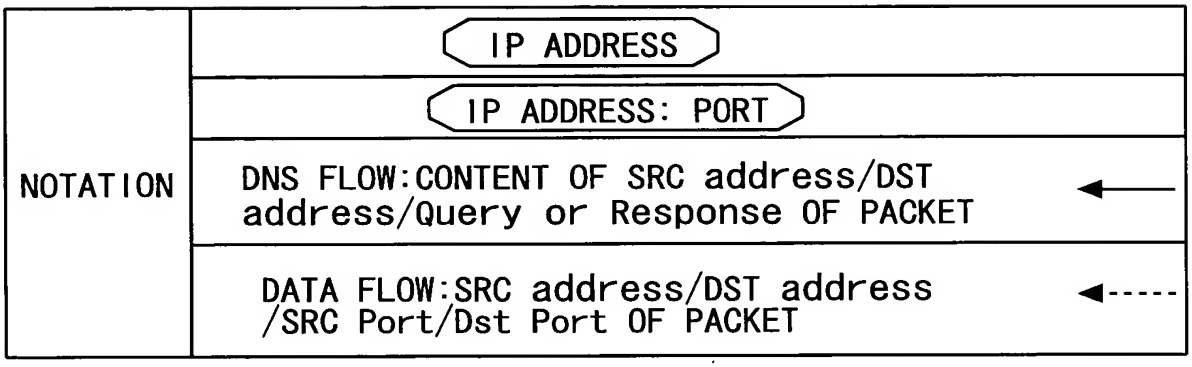

NOTATION
IP ADDRESS
IP ADDRESS: PORT
DNS FLOW:CONTENT OF SRC address/DST address/Query or Response OF PACKET
DATA FLOW:SRC address/DST address /SRC Port/Dst Port OF PACKET

FIG. 4

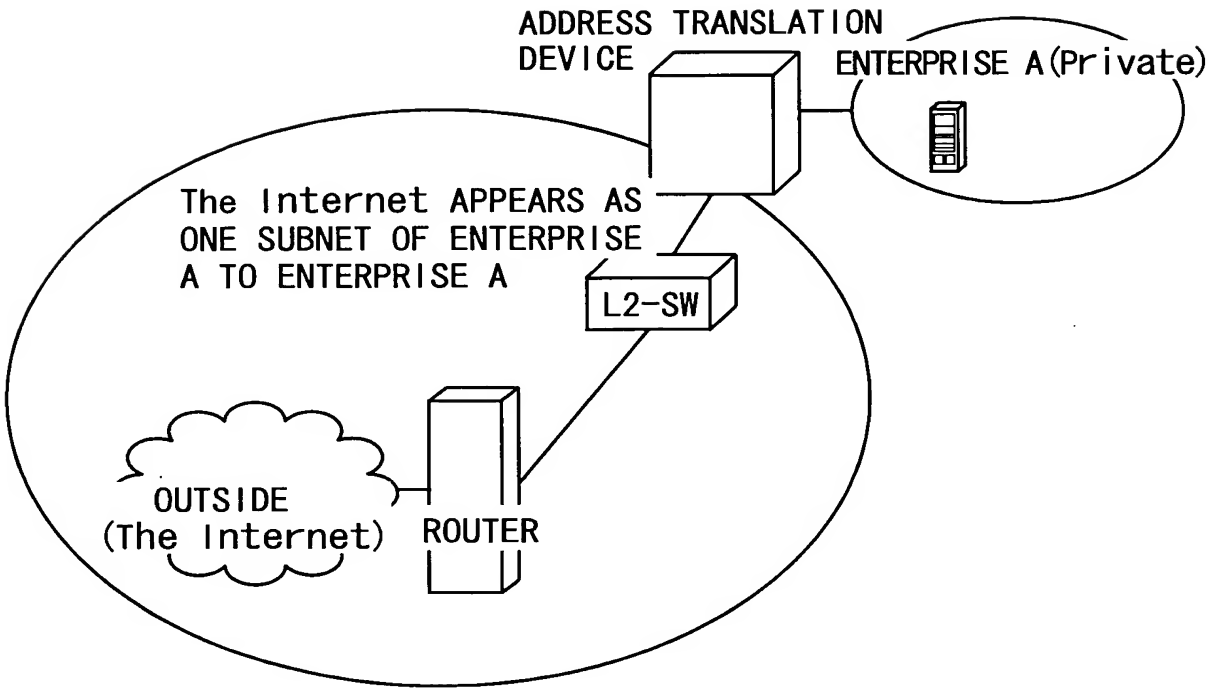

ADDRESS TRANSLATION DEVICE
ENTERPRISE A(Private)
The Internet APPEARS AS ONE SUBNET OF ENTERPRISE A TO ENTERPRISE A
L2-SW
OUTSIDE (The Internet)
ROUTER

FIG. 5

QUERIER OF NAME RESOLUTION REQUEST / TERMINAL LOCATION WITH NAME TO BE RESOLVED	PRIVATE IP ADDRESS NETWORK	GLOBAL IP ADDRESS NETWORK
PRIVATE IP ADDRESS NETWORK	(1) OPERTION AS DNS SERVER ON NORMAL PRIVATE IP ADDRESS NETWORK	(2) REJECTION OF NAME RESOLUTION REQUEST
GLOBAL IP ADDRESS NETWORK	(3) RESPONSE GIVEN AFTER JUDGING ABOUT CONNECTABILITY AND NON-CONNECTABILITY	(4) OPERATION AS DNS SERVER ON NORMAL GLOBAL IP ADDRESS NETWORK

FIG. 6

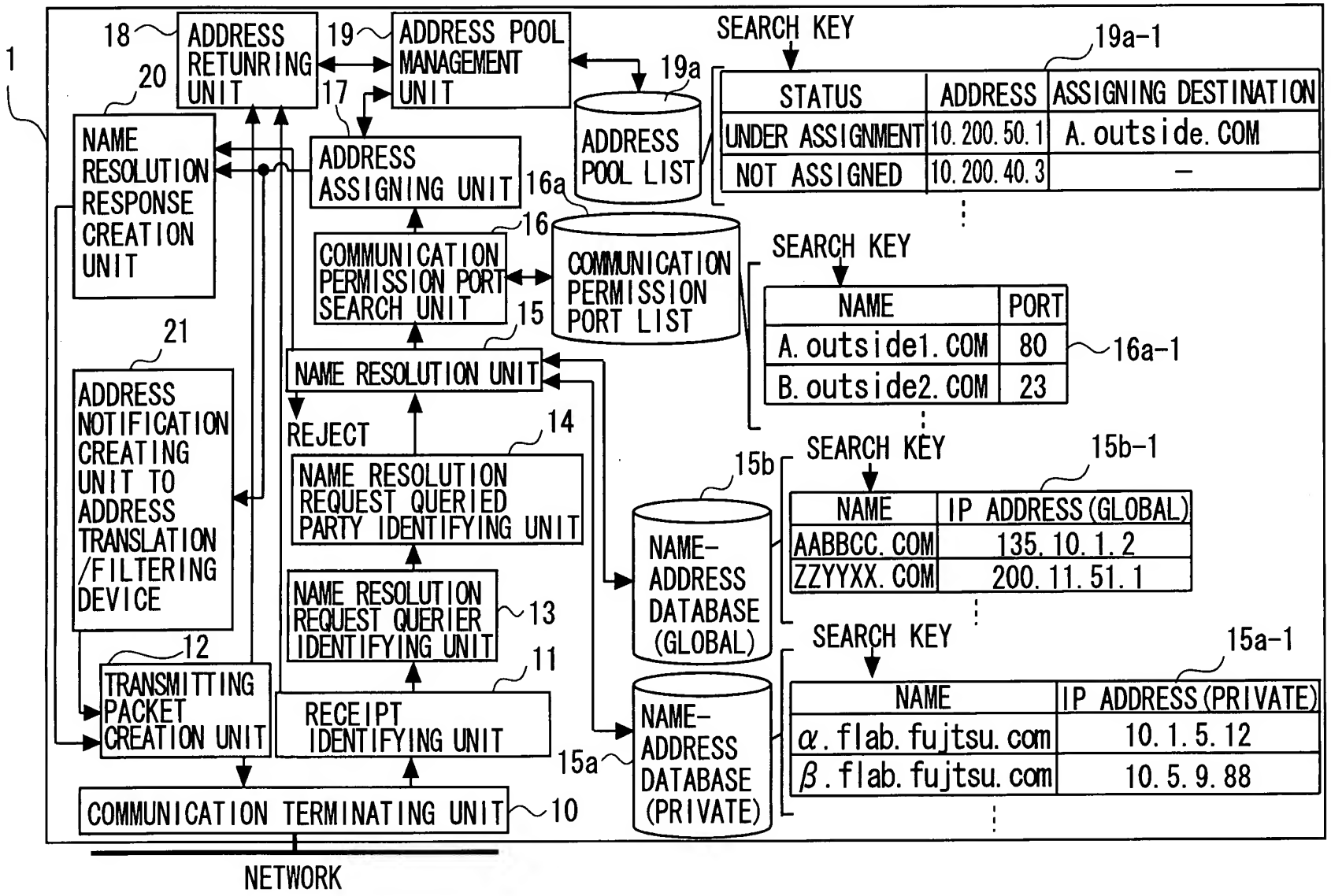

1
18
ADDRESS RETUNRING UNIT
19
ADDRESS POOL MANAGEMENT UNIT
19a
SEARCH KEY
19a-1
20
17
NAME RESOLUTION RESPONSE CREATION UNIT
ADDRESS ASSIGNING UNIT
ADDRESS POOL LIST
STATUS
ADDRESS
ASSIGNING DESTINATION
UNDER ASSIGNMENT
10.200.50.1
A.outside.COM
NOT ASSIGNED
10.200.40.3
–
16a
16
COMMUNICATION PERMISSION PORT SEARCH UNIT
COMMUNICATION PERMISSION PORT LIST
SEARCH KEY
NAME
PORT
A.outside1.COM
80
16a-1
B.outside2.COM
23
15
21
NAME RESOLUTION UNIT
ADDRESS NOTIFICATION CREATING UNIT TO ADDRESS TRANSLATION /FILTERING DEVICE
REJECT
14
NAME RESOLUTION REQUEST QUERIED PARTY IDENTIFYING UNIT
15b
SEARCH KEY
15b-1
NAME
IP ADDRESS(GLOBAL)
AABBCC.COM
135.10.1.2
ZZYYXX.COM
200.11.51.1
NAME-ADDRESS DATABASE (GLOBAL)
NAME RESOLUTION REQUEST QUERIER IDENTIFYING UNIT
13
12
11
TRANSMITTING PACKET CREATION UNIT
RECEIPT IDENTIFYING UNIT
SEARCH KEY
15a-1
NAME
IP ADDRESS(PRIVATE)
α.flab.fujtsu.com
10.1.5.12
β.flab.fujtsu.com
10.5.9.88
15a
NAME-ADDRESS DATABASE (PRIVATE)
COMMUNICATION TERMINATING UNIT
10
NETWORK

FIG. 7

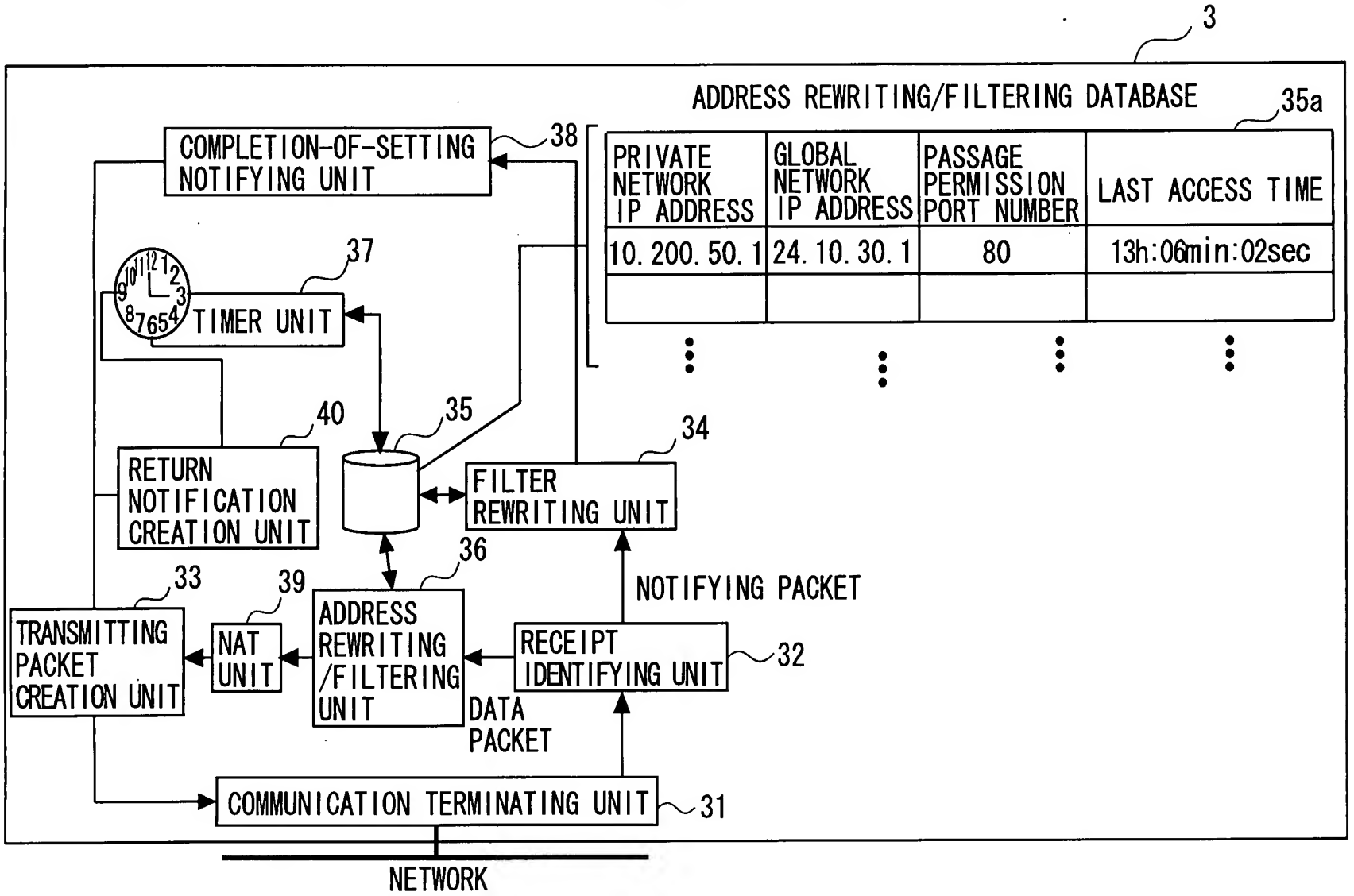

3
ADDRESS REWRITING/FILTERING DATABASE
35a
COMPLETION-OF-SETTING NOTIFYING UNIT
38
PRIVATE NETWORK IP ADDRESS
GLOBAL NETWORK IP ADDRESS
PASSAGE PERMISSION PORT NUMBER
LAST ACCESS TIME
10.200.50.1
24.10.30.1
80
13h:06min:02sec
37
TIMER UNIT
40
35
34
RETURN NOTIFICATION CREATION UNIT
FILTER REWRITING UNIT
36
33
39
NOTIFYING PACKET
TRANSMITTING PACKET CREATION UNIT
NAT UNIT
ADDRESS REWRITING /FILTERING UNIT
RECEIPT IDENTIFYING UNIT
32
DATA PACKET
COMMUNICATION TERMINATING UNIT
31
NETWORK

FIG. 8

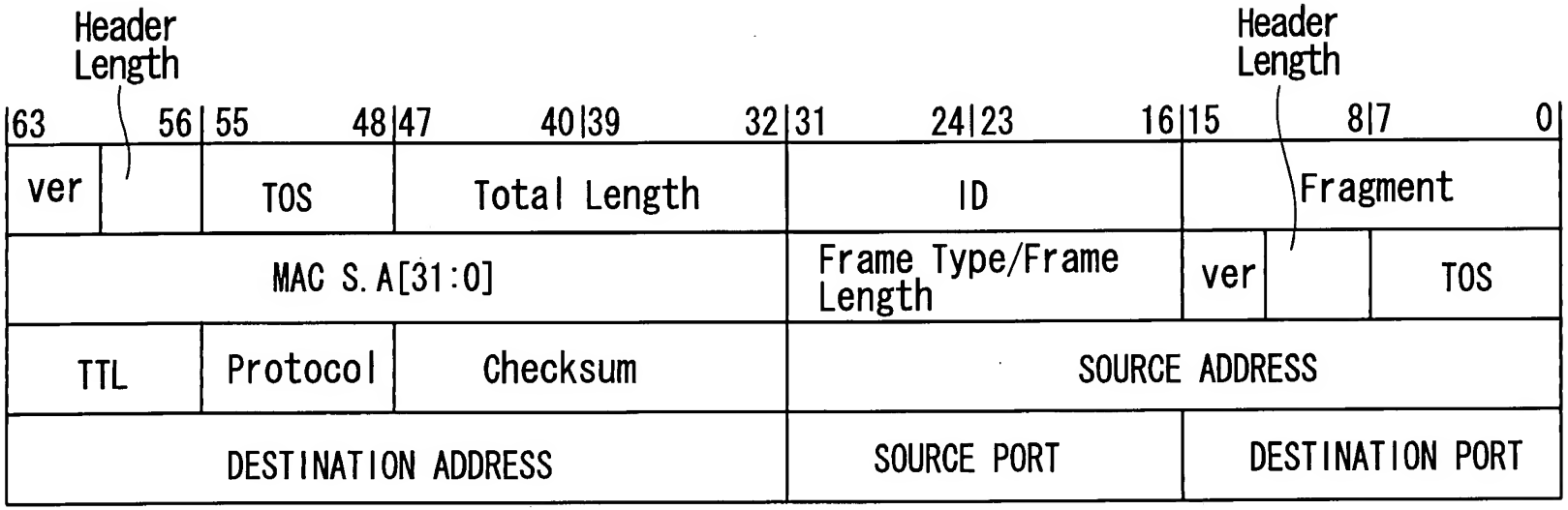

Header Length
Header Length
63
56
55
48
47
40
39
32
31
24
23
16
15
8
7
0
ver
TOS
Total Length
ID
Fragment
MAC S.A[31:0]
Frame Type/Frame Length
ver
TOS
TTL
Protocol
Checksum
SOURCE ADDRESS
DESTINATION ADDRESS
SOURCE PORT
DESTINATION PORT

FIG. 9

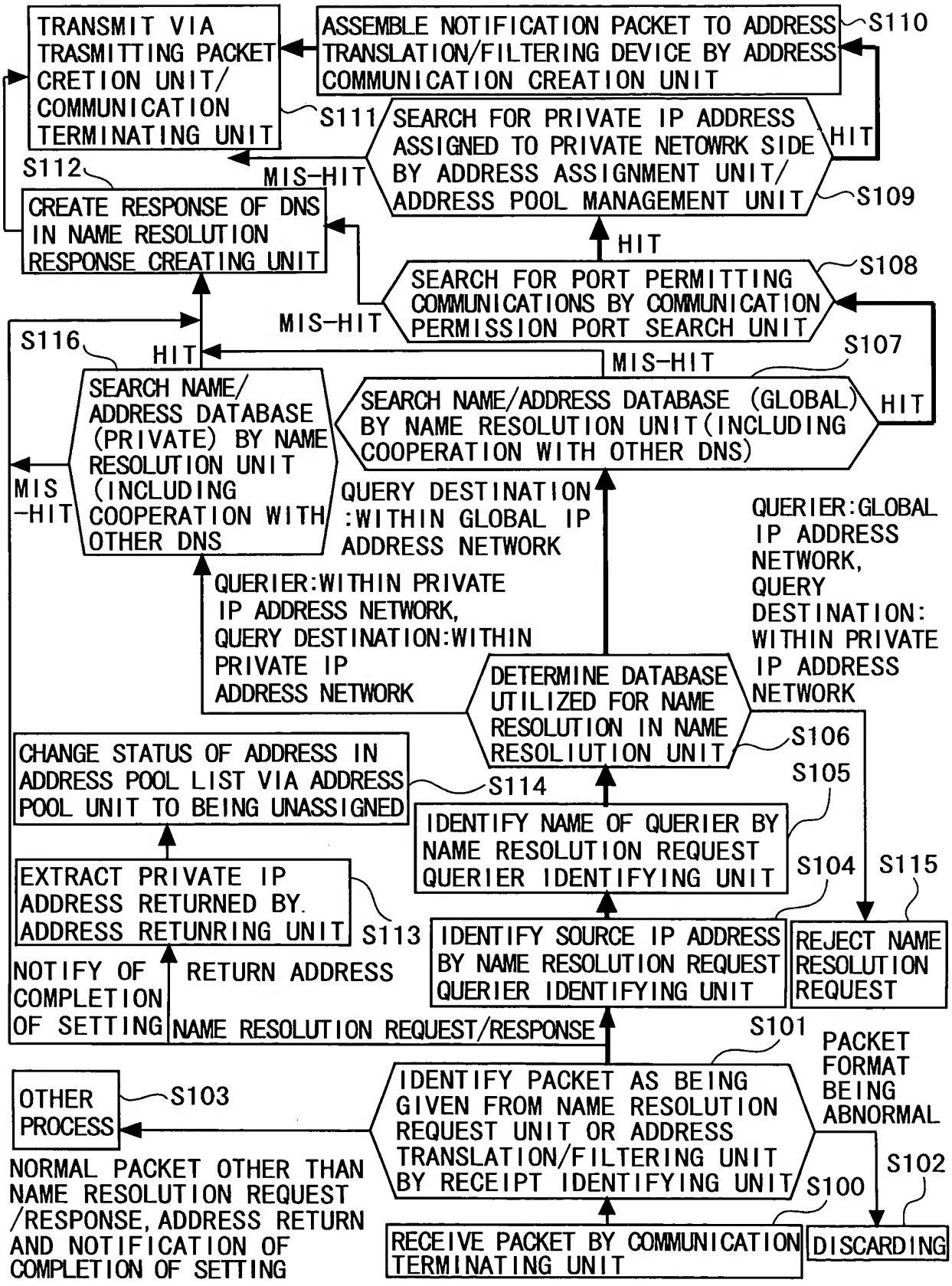

TRANSMIT VIA TRASMITTING PACKET CRETION UNIT/ COMMUNICATION TERMINATING UNIT
ASSEMBLE NOTIFICATION PACKET TO ADDRESS TRANSLATION/FILTERING DEVICE BY ADDRESS COMMUNICATION CREATION UNIT
S110
S111
SEARCH FOR PRIVATE IP ADDRESS ASSIGNED TO PRIVATE NETOWRK SIDE BY ADDRESS ASSIGNMENT UNIT/ ADDRESS POOL MANAGEMENT UNIT
HIT
S109
S112
MIS-HIT
CREATE RESPONSE OF DNS IN NAME RESOLUTION RESPONSE CREATING UNIT
HIT
SEARCH FOR PORT PERMITTING COMMUNICATIONS BY COMMUNICATION PERMISSION PORT SEARCH UNIT
S108
MIS-HIT
S116
HIT
MIS-HIT
S107
SEARCH NAME/ ADDRESS DATABASE (PRIVATE) BY NAME RESOLUTION UNIT (INCLUDING COOPERATION WITH OTHER DNS
SEARCH NAME/ADDRESS DATABASE (GLOBAL) BY NAME RESOLUTION UNIT (INCLUDING COOPERATION WITH OTHER DNS)
HIT
MIS -HIT
QUERY DESTINATION :WITHIN GLOBAL IP ADDRESS NETWORK
QUERIER:GLOBAL IP ADDRESS NETWORK, QUERY DESTINATION: WITHIN PRIVATE IP ADDRESS NETWORK
QUERIER:WITHIN PRIVATE IP ADDRESS NETWORK, QUERY DESTINATION:WITHIN PRIVATE IP ADDRESS NETWORK
DETERMINE DATABASE UTILIZED FOR NAME RESOLUTION IN NAME RESOLIUTION UNIT
S106
CHANGE STATUS OF ADDRESS IN ADDRESS POOL LIST VIA ADDRESS POOL UNIT TO BEING UNASSIGNED
S114
S105
IDENTIFY NAME OF QUERIER BY NAME RESOLUTION REQUEST QUERIER IDENTIFYING UNIT
S104
S115
EXTRACT PRIVATE IP ADDRESS RETURNED BY. ADDRESS RETUNRING UNIT
S113
IDENTIFY SOURCE IP ADDRESS BY NAME RESOLUTION REQUEST QUERIER IDENTIFYING UNIT
REJECT NAME RESOLUTION REQUEST
NOTIFY OF COMPLETION OF SETTING
RETURN ADDRESS
NAME RESOLUTION REQUEST/RESPONSE
S101
PACKET FORMAT BEING ABNORMAL
OTHER PROCESS
S103
IDENTIFY PACKET AS BEING GIVEN FROM NAME RESOLUTION REQUEST UNIT OR ADDRESS TRANSLATION/FILTERING UNIT BY RECEIPT IDENTIFYING UNIT
S102
NORMAL PACKET OTHER THAN NAME RESOLUTION REQUEST /RESPONSE, ADDRESS RETURN AND NOTIFICATION OF COMPLETION OF SETTING
S100
RECEIVE PACKET BY COMMUNICATION TERMINATING UNIT
DISCARDING

FIG. 10

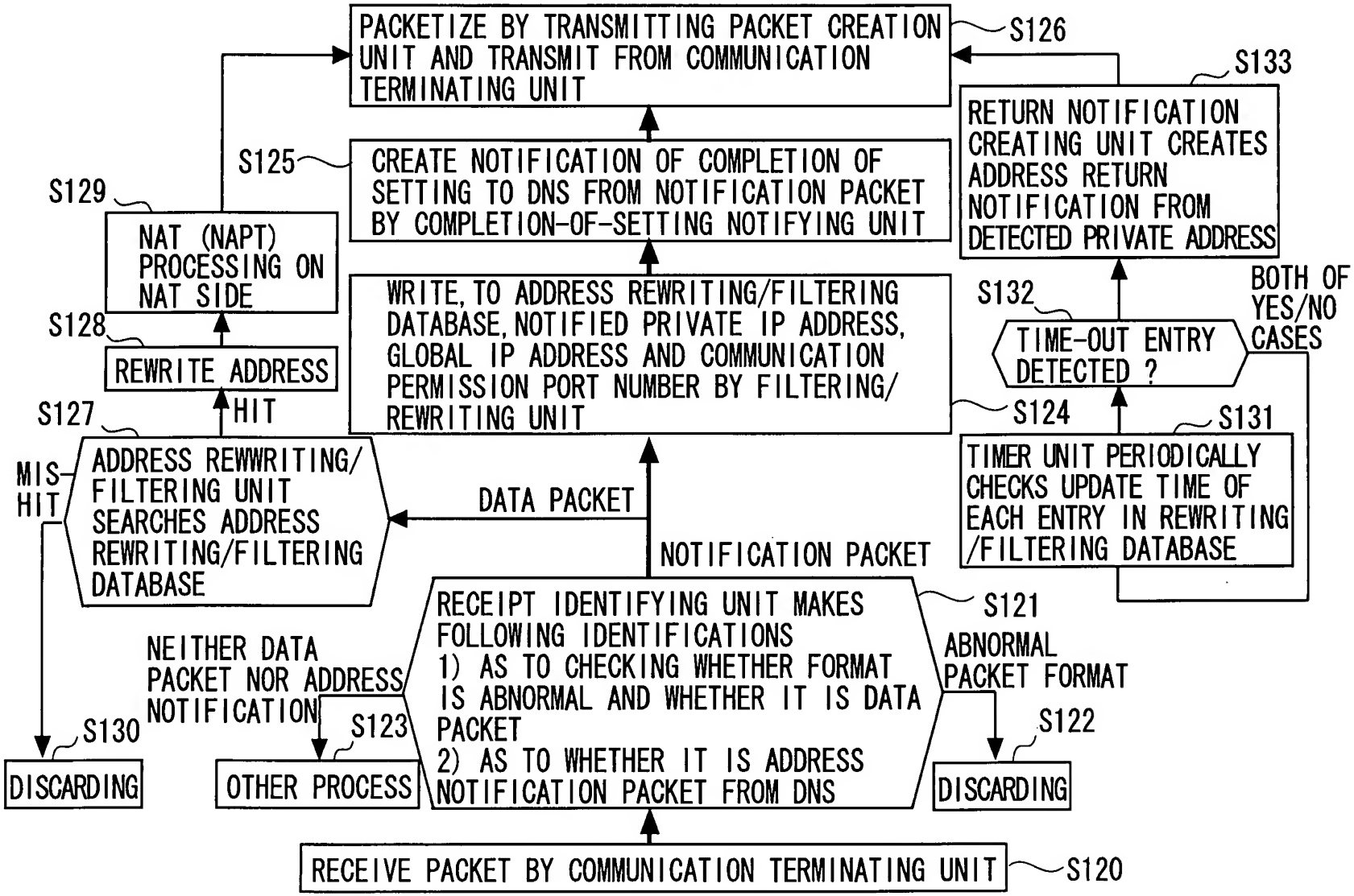

PACKETIZE BY TRANSMITTING PACKET CREATION UNIT AND TRANSMIT FROM COMMUNICATION TERMINATING UNIT
S126
S133
RETURN NOTIFICATION CREATING UNIT CREATES ADDRESS RETURN NOTIFICATION FROM DETECTED PRIVATE ADDRESS
S125
CREATE NOTIFICATION OF COMPLETION OF SETTING TO DNS FROM NOTIFICATION PACKET BY COMPLETION-OF-SETTING NOTIFYING UNIT
S129
NAT (NAPT) PROCESSING ON NAT SIDE
WRITE, TO ADDRESS REWRITING/FILTERING DATABASE, NOTIFIED PRIVATE IP ADDRESS, GLOBAL IP ADDRESS AND COMMUNICATION PERMISSION PORT NUMBER BY FILTERING/ REWRITING UNIT
S132
BOTH OF YES/NO CASES
TIME-OUT ENTRY DETECTED ?
S128
REWRITE ADDRESS
S124
S131
S127
HIT
TIMER UNIT PERIODICALLY CHECKS UPDATE TIME OF EACH ENTRY IN REWRITING /FILTERING DATABASE
MIS-HIT
ADDRESS REWWRITING/ FILTERING UNIT SEARCHES ADDRESS REWRITING/FILTERING DATABASE
DATA PACKET
NOTIFICATION PACKET
RECEIPT IDENTIFYING UNIT MAKES FOLLOWING IDENTIFICATIONS
1) AS TO CHECKING WHETHER FORMAT IS ABNORMAL AND WHETHER IT IS DATA PACKET
2) AS TO WHETHER IT IS ADDRESS NOTIFICATION PACKET FROM DNS
S121
NEITHER DATA PACKET NOR ADDRESS NOTIFICATION
ABNORMAL PACKET FORMAT
S130
S123
S122
DISCARDING
OTHER PROCESS
DISCARDING
RECEIVE PACKET BY COMMUNICATION TERMINATING UNIT
S120

FIG. 11A

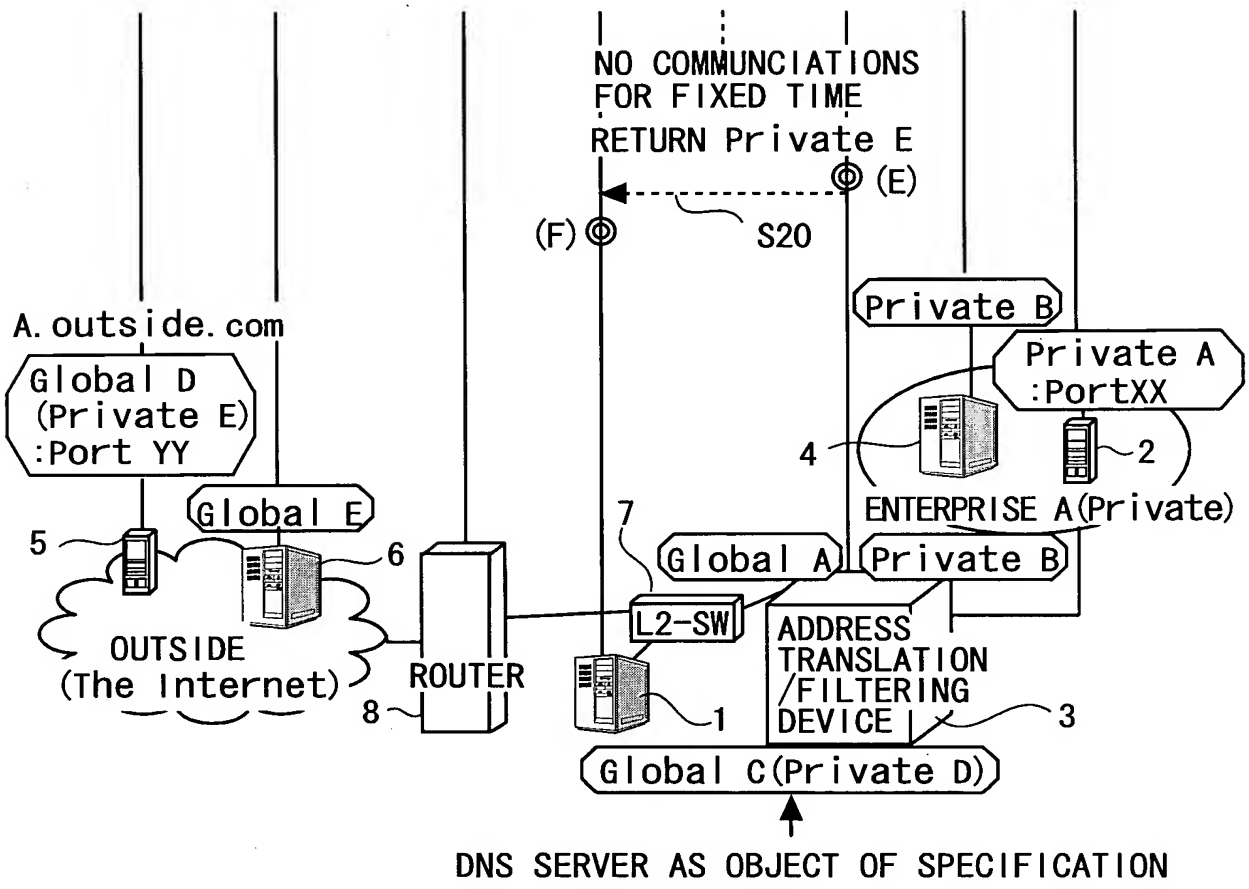


FIG. 11B

NOTATION	IP ADDRESS
	IP ADDRESS: PORT
	DATA FLOW: ◄-----

FIG. 12A

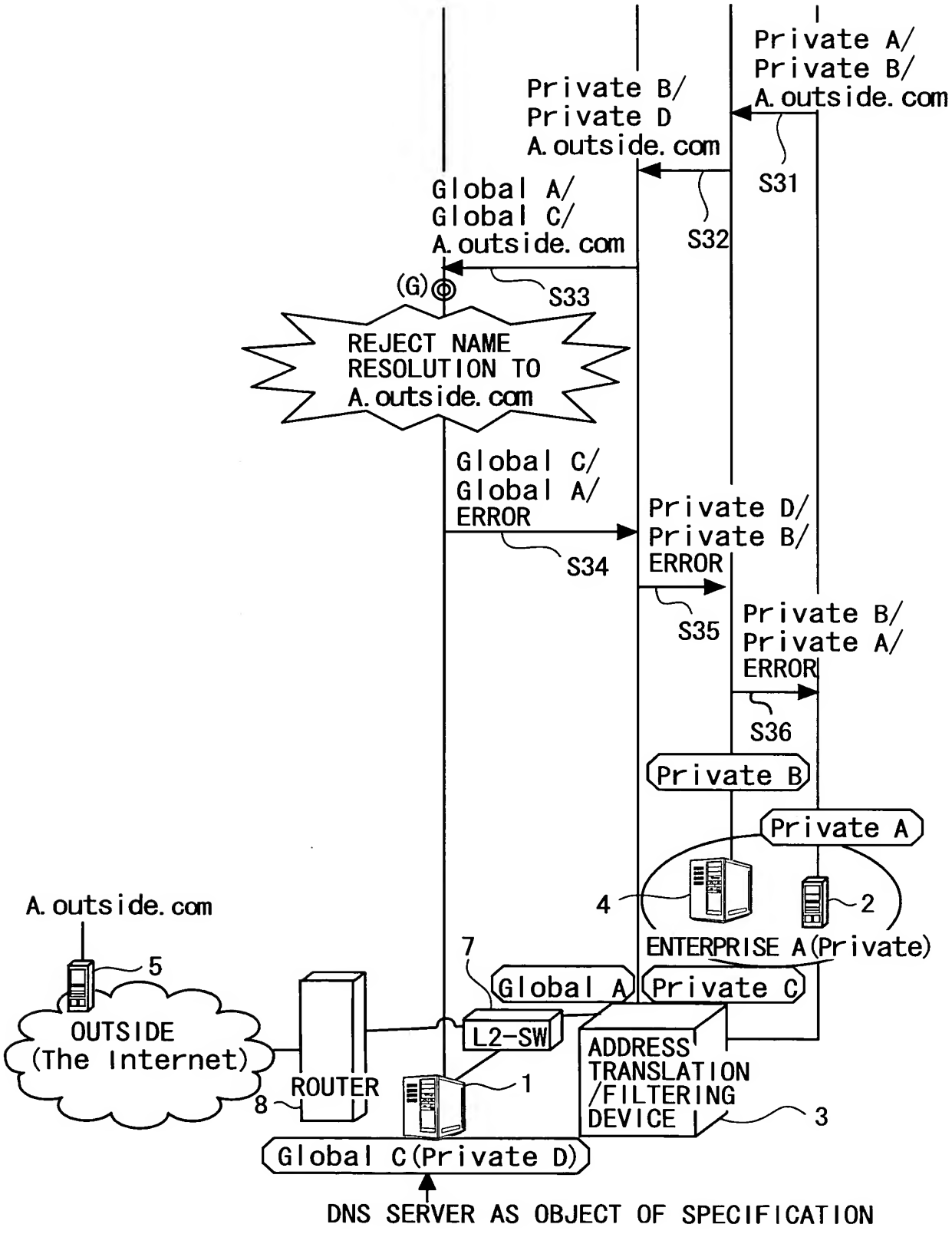

Private A/
Private B/
A.outside.com
Private B/
Private D
A.outside.com
S31
Global A/
Global C/
A.outside.com
S32
(G)
S33
REJECT NAME
RESOLUTION TO
A.outside.com
Global C/
Global A/
ERROR
S34
Private D/
Private B/
ERROR
S35
Private B/
Private A/
ERROR
S36
Private B
Private A
A.outside.com
4
2
ENTERPRISE A(Private)
7
5
Global A
Private C
OUTSIDE
(The Internet)
L2-SW
ADDRESS
TRANSLATION
/FILTERING
DEVICE
3
ROUTER
8
1
Global C(Private D)
DNS SERVER AS OBJECT OF SPECIFICATION

FIG. 12B

	IP ADDRESS
NOTATION	DNS FLOW:CONTENT OF SRC address/DST address/Query or Response OF PACKET ←

FIG. 13A

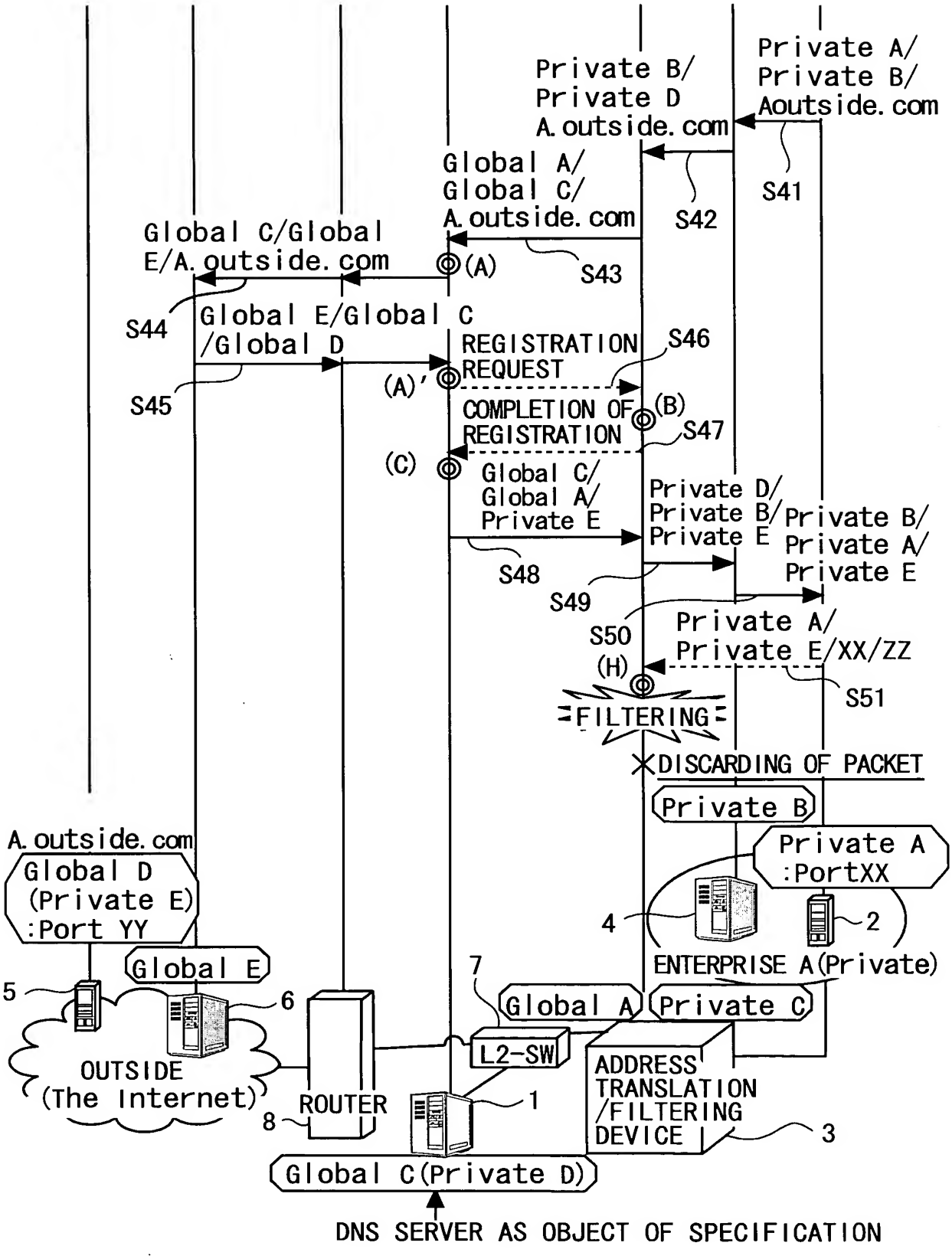

Private B/
Private D
A.outside.com
Private A/
Private B/
Aoutside.com
Global A/
Global C/
A.outside.com
S41
S42
Global C/Global
E/A.outside.com
(A)
S43
S44
Global E/Global C
/Global D
REGISTRATION
REQUEST
S46
(A)'
S45
COMPLETION OF
REGISTRATION
(B)
S47
(C)
Global C/
Global A/
Private E
Private D/
Private B/
Private E
Private B/
Private A/
Private E
S48
S49
S50
Private A/
Private E/XX/ZZ
(H)
S51
FILTERING
DISCARDING OF PACKET
Private B
A.outside.com
Global D
(Private E)
:Port YY
Private A
:PortXX
4
2
Global E
ENTERPRISE A(Private)
5
7
6
Global A
Private C
L2-SW
OUTSIDE
(The Internet)
ADDRESS
TRANSLATION
/FILTERING
DEVICE
3
ROUTER
8
1
Global C(Private D)
DNS SERVER AS OBJECT OF SPECIFICATION

FIG. 13B

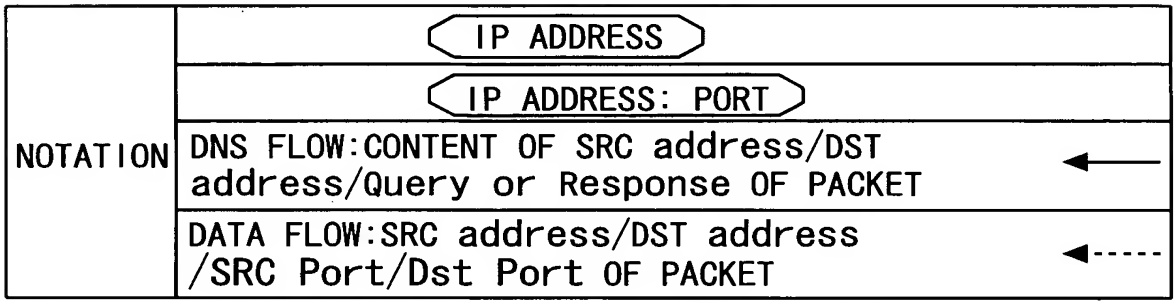

NOTATION
IP ADDRESS
IP ADDRESS: PORT
DNS FLOW:CONTENT OF SRC address/DST address/Query or Response OF PACKET
DATA FLOW:SRC address/DST address /SRC Port/Dst Port OF PACKET

FIG. 14A

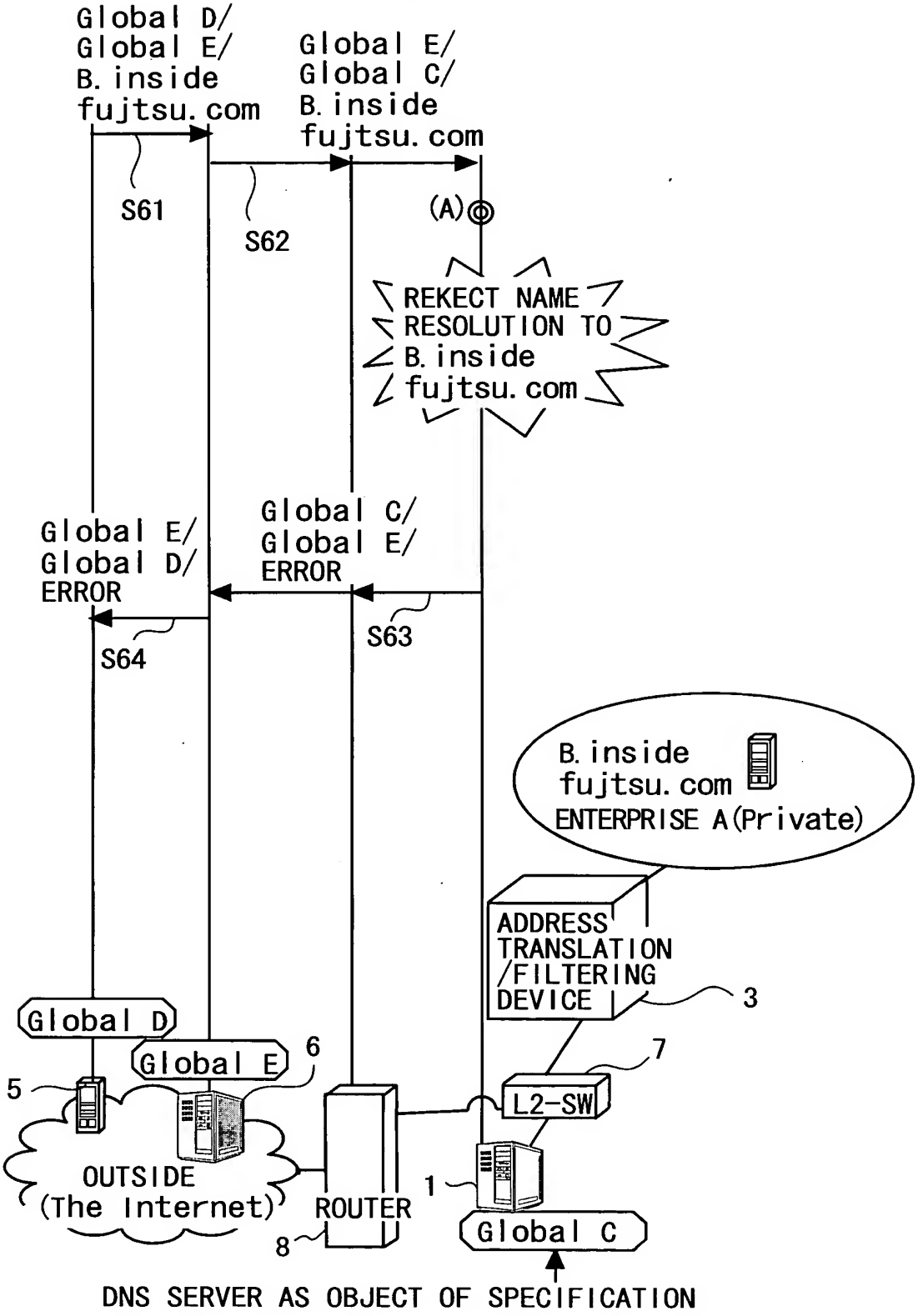

Global D/
Global E/
B.inside
fujtsu.com
Global E/
Global C/
B.inside
fujtsu.com
S61
S62
(A)
REKECT NAME
RESOLUTION TO
B.inside
fujtsu.com
Global E/
Global D/
ERROR
Global C/
Global E/
ERROR
S64
S63
B.inside
fujtsu.com
ENTERPRISE A(Private)
ADDRESS
TRANSLATION
/FILTERING
DEVICE
3
Global D
Global E
6
7
5
L2-SW
OUTSIDE
(The Internet)
ROUTER
1
8
Global C
DNS SERVER AS OBJECT OF SPECIFICATION

FIG. 14B

NOTATION	IP ADDRESS
	DNS FLOW:CONTENT OF SRC address/DST address/Query or Response OF PACKET ←

FIG. 15A

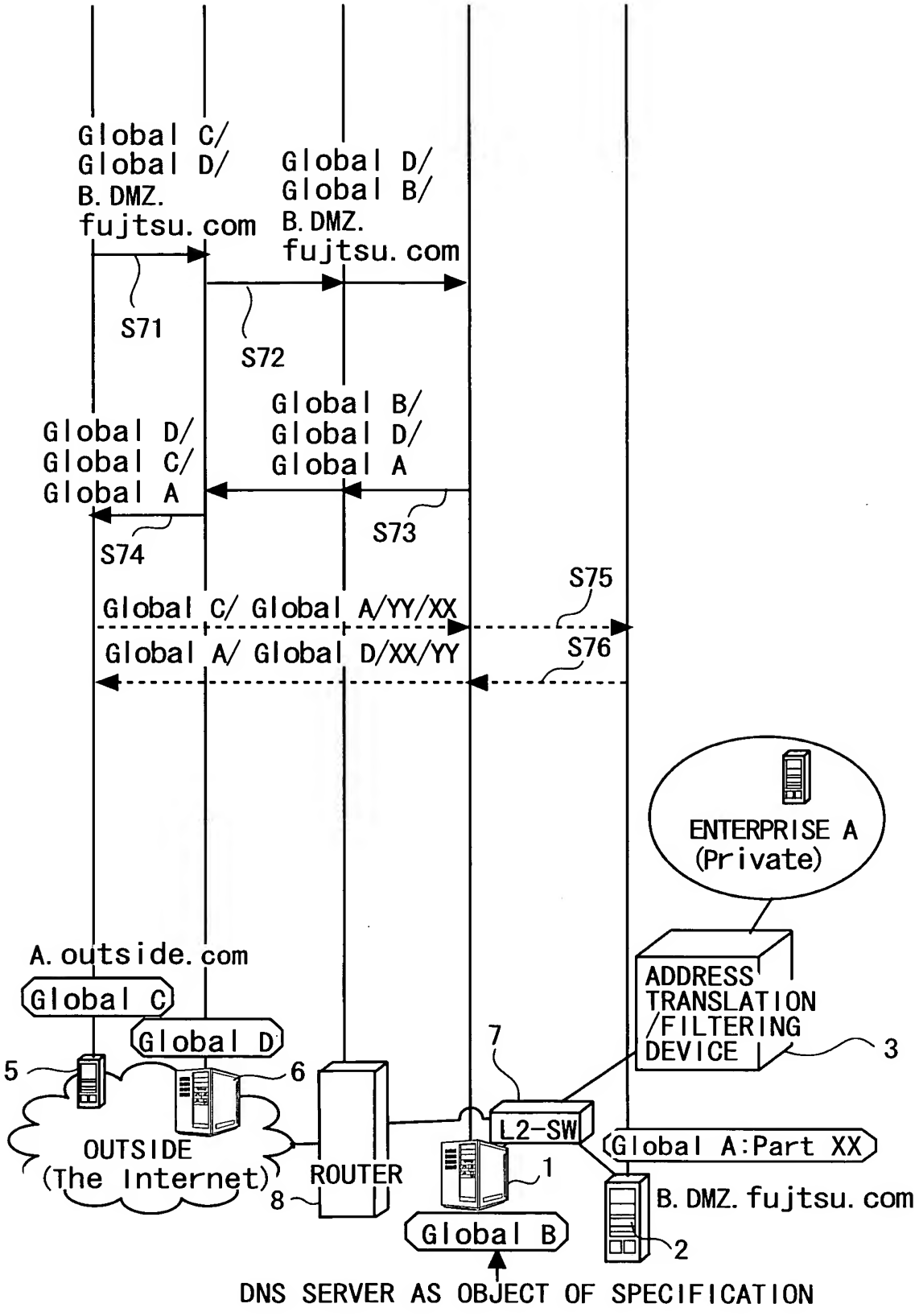
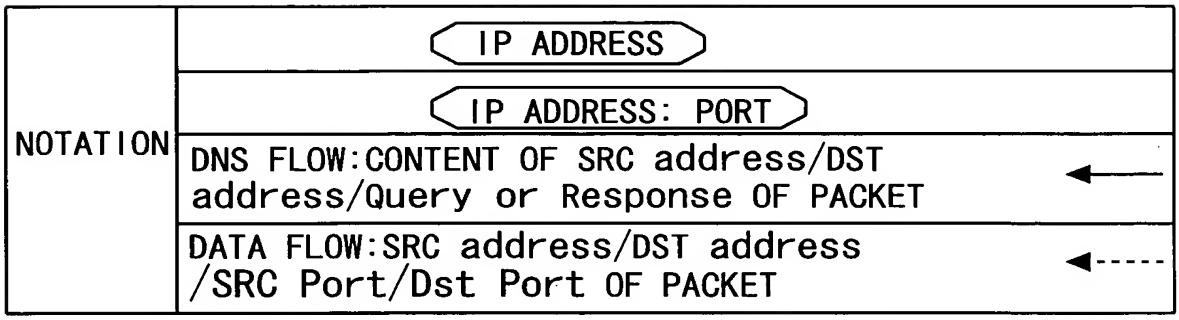

Global C/
Global D/
B.DMZ.
fujtsu.com
Global D/
Global B/
B.DMZ.
fujtsu.com
S71
S72
Global B/
Global D/
Global A
Global D/
Global C/
Global A
S73
S74
S75
Global C/ Global A/YY/XX
Global A/ Global D/XX/YY
S76
ENTERPRISE A
(Private)
ADDRESS
TRANSLATION
/FILTERING
DEVICE
3
A.outside.com
Global C
Global D
5
6
7
L2-SW
Global A:Part XX
OUTSIDE
(The Internet)
ROUTER
8
1
B.DMZ.fujtsu.com
2
Global B
DNS SERVER AS OBJECT OF SPECIFICATION

FIG. 15B


NOTATION
IP ADDRESS
IP ADDRESS: PORT
DNS FLOW:CONTENT OF SRC address/DST address/Query or Response OF PACKET
DATA FLOW:SRC address/DST address /SRC Port/Dst Port OF PACKET